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ENERGY AND REALITY.[1]

I. IS EXPERIENCE SELF-SUPPORTING?

THE story of the concept of being is a long one and constitutes pretty much the whole story of philosophy. But whatever may be our opinion of *Urstoff*, upon one thing we are now agreed, that experience stuff, as revealed in our immediate feelings and sensations, on the one hand, and our ideal construction, on the other, must be the starting-point of all our investigations. In terms of this we must differentiate and express the problems of the universe in so far as they can be expressed. But is reality through and through experience?

It has been maintained from time to time, and recently by so brilliant an advocate as Professor James, that experience is self-sufficient; that it "leans on nothing but itself"; and that we have no need, therefore, of any reference outside of experience. If we examine the problems of experience more closely, however, we shall find that experience in many ways seems to depend upon an extra-experiential constitution. I shall mention a few cases in which experience implies such a constitution.

For one thing, experience does not account for its own continuity, either as involved in intersubjective relations in space or as involved in bridging over from moment to moment in time. To speak of the former continuity first: In order for two egos or subjects to come to an understanding with each other, or to communicate their feelings and ideas by means of "winged words," something more is necessary than their respective fields of consciousness. Certain processes must be interpolated, such as physiological movements on the part of the speaker, air-waves which take up these movements, and end-organs, with a nervous system, reacting to these stimuli on the part of the listener. Now these intermediate processes can not be regarded as experience in their own right. Unless we go back to the breathing world of Anaximenes we would not be likely to regard air-waves as themselves experience. Even the immediatist, unless he is a solipsist, would have to admit that other people's immediacy is not his immediacy, but is communicated by the help of intermediary processes. This would be true even on a telepathic hypothesis. How it is possible, by means of such non-conscious intermediaries, for conscious egos to meet in a common world, we can not discuss here.

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[1] This paper is the fifth and last in a series of studies on the attributes of reality. The first study appeared as a monograph, entitled "Time and Reality," *Psychological Review, Monograph Series*, No. 26, 1904; "Space and Reality," this JOURNAL, Vol. III., pp. 533, 589; "The Ought and Reality," *International Journal of Ethics*, Vol. XVII., p. 454; and "Consciousness and Reality," this JOURNAL, Vol. V., pp. 169, 225.

But, in the second place, we can not account for the continuity of experience in time, any more than in space, as leaning upon nothing but experience. To use Professor James's illustration: Peter and Paul go to sleep in the same bed; and while not conscious in the meantime, so far as evidence proves, each one, on waking up, is immediately conscious of his own past, and one does not get mixed up with the other. Such continuity between our waking moments, bridging over the intervals of experience, must require something besides experience. The reason that experience in waking up connects with experience before going to sleep is that both lean upon a world of processes which is not experiential. The machinery of association, upon which living-over experience depends, is not itself experience. Nor could we invoke here a permanent experience as a solution of the problem; for the permanent experience surely could not account for the coming and going of experience as we know it. The same idea might be illustrated equally well with reference to social experience or the funded knowledge of the race. Clay tablets constituting libraries of ancient lore have been unearthed in recent years in the Orient. Were the ancient libraries of Nineveh and Babylon experience while buried in the ruins? Did they not rather become experience again, after thousands of years, when they were unearthed and deciphered by recent discoverers? Perhaps you retort that they were possible experience in the meantime. But what does possible experience mean in such a case except that they were *not* experience until they became continuous, as perception and interpretation, with human beings who stumbled upon the libraries? The phrase "possible experience" only hides the problem; and if it means anything when pressed home, it is that experience sometimes leans on processes that are not experience. Possible experience, which is not experience, is no more experience than possible electricity, without all the conditions for electricity, is electricity. Whether within individual history, therefore, or within the history of the race, it is evident that, when you try to explain its continuity, experience leans upon an extra-experiential constitution.

What I have shown with reference to continuity might be shown equally well with reference to interest. Take, first, a case of primary interest. Why do brilliant things, moving things, loud things, things to suck, etc., fascinate the infant? Why does the chicken peck at certain things on the ground and shy away at certain movements, etc.? Not because of experience, surely, because it has no past experience to bank on. If we would find the explanation for such interest, we must go to biological structure and not to psychological association. We sum it up by saying that the child and the chicken are so constituted as to feel this way in the presence of such stimuli. Evidently experience leans upon what is not experience, as regards primary interest.

And if you take into account the more general demands or postulates that underlie psychological activities, they, too, seem to carry us beyond experience. Why is consistency pleasing and contradiction disagreeable to the cultured man? Why do certain forms and combinations of colors and of sounds stimulate him to appreciation and excite the feeling for the beautiful? Why do certain things provoke disgust and other things approval? Partly, no doubt, on account of experience; but if certain instinctive qualifications were lacking, or if the instinctive constitution were different, the same situations might produce entirely opposite feelings on the part of individual experience, as is exemplified even now in different races.

But not only is the woof of experience in the making thus conditioned by an instinctive warp which experience can not make or explain, but culture and meaning, the net result of experience and tendency, are funded in a way which, to a large extent at least, is unavailable as experience. Physiological tendency comes to do the work of memory. It is precious little that a man out of college twenty years, and engaged in new pursuits, can recall of his college curriculum. And yet he feels differently and acts differently because of his college course. Here, again, in the very definition of culture, we come upon a subtle relation to a reality which is not experience. The ego, therefore, whatever else it may be, is not merely a "bundle of perceptions" or of any other conscious states. They are not the whole story, at least.

Another road might have been chosen to show the insufficiency of experience as an account of reality. If we take the immediatist point of view, what reality can we accord to nature? Is nature merely a "bundle of perceptions"? We have already found such an account inadequate to the ego; on closer scrutiny we shall find it equally inadequate to nature. If we insist that the objects of nature are statable merely as our perceptions, we must be prepared to answer several questions. Does reality consist merely in the perceptual differences that things *do* make, or does it also include the differences which they *can* or *will* make under other conditions than the present? But if we admit *will* and *can,* have we not admitted a larger constitution than experience? And, then, what about the constancies or uniformities in our perceptions, upon which all our expectancies or scientific laws are based? Is it part of perception that perceptions shall repeat themselves in certain describable and definite ways? But if perceptions do not exist in the meantime, it is hard to see how this uniformity or repetition can be a character of the perceptions. If *esse* is *percipi,* it is hard to see what reality there can be when there is no *percipi.* In the prediction of an eclipse a thousand years from now, or the reading of an eclipse a thousand years ago, there surely is no present perception of the fact; and absent perception is hardly perception. If there can be such a thing, then, as future perceptions or the reading off of past perceptions, experience must lean upon a non-experiential constitution.

But this is not the whole difficulty of the phenomenalistic theory of nature. A deeper problem confronts us. Can an individual, whether conscious or unconscious, be resolved into relations? Can a thing be regarded as having merely an outside and no inside? By thus regarding it we shall, indeed, avoid the knotty problem of "the thing itself"; but is our account of reality fair and complete? Is a thing merely what it does, as Lotze and Plato's Eleatic Stranger tell us, waiving for the time being the difficulty of what it may do? In the case of one sort of thing at least, namely the purposive ego, we must admit that he is not merely what he does, his external continuities, in the sense of the perceptions he produces in us; but he is also something on his own account, a center of appreciation and willing. This is the real core of the ego, not the sight-touch-motor complex. The latter is the clothes, or part of them; and an individual consisting merely of clothes would be a funny sort of an individual. The ego, to use a good Hegelian distinction, must be something *für sich* and not merely *an sich,* something on its own account as well as something for others. If only purposive beings have an inside, is the baby merely an outside, merely clothes? It seems to have a core of feeling of its own, however crude. And what about animals? Are they merely an outside with no inside? No, they, too, seem to have a core of appetite and feeling which we must acknowledge. And while we know little about the simpler forms of nature, at least they are not merely fictions of ours. Our agreements about them are *forced* agreements; they are not created by convention; and we must learn to adjust ourselves to these simpler realities in order to control them and realize our purposes. If we would keep dry in the rain-storm, we must bring our umbrella and other togs along. Approaching the problem, then, from the point of view of the will or our active purposes, we can not resolve reality, whether conscious or unconscious, into bundles of perception, or into experience of any form, altogether.

But how shall we conceive this extra-experiential constitution? Two important hypotheses have become classical, one that of independent and immutable substances, and the other that of the absolute. First, a word as regards the hypothesis of substances. The realistic substances may be material or spiritual; they may be the atoms of Democritus or the monads of Leibniz. It is quite wrong, then, to accuse the older realism of being materialistic. On the other hand, the substances which have counted in science have, until recent times at least, been of the extended or materialistic order. The monads of Leibniz and the qualities of Herbart have not counted in the development of science, interesting though they have been as metaphysical curiosities. The atomic theory of Democritus, adopted by modern chemistry and made exact through Berzelius's conception of weight proportions, has, on account of its convenience for modern science, come to stand for our ideal of realism.

In the older conception of atomic realism, the geometrical properties, depending upon extension, are the important ones; even after the idea of energy, in the sense of doing work, became a permanent concept in physical science, the concept of extension was long allowed to rank with the concept of energy. This gives rise to Herbert Spencer's antinomy as regards extension and force. This antinomy, however, is losing much of its relevancy by the fact that extension or mass is relegated to at least a second place in the scientific conception of physical nature.

If the physicists had consulted the philosophers and psychologists, they could have learned long ago that extension is a confused idea and has no reality outside of individual experience. Berkeley pointed out, with his psychological keenness, that the size of a thing varies with the distance and that the form varies with the angle of the perspective. He concluded, therefore, that matter could not be real. Modern psychology, with less of metaphysical interest, but with superior experimental tools, has likewise pointed out the relative character of extension. Thus it is shown that the extension seems longer when the intervening space is filled than when it is empty, whether you take tactual extension or visual extension. Where the area is too small for two points to be discriminated as two, they still have the feeling of a bigger point than either of the points previously discriminated. When a number of points are made to stimulate the skin cells or the retinal cells successively, the extension seems larger than if the stimulation is simultaneous. Even as regards sound, we find an interesting relation between the rate of succession of physical stimuli and the sense of volume. Sounds succeeding each other at the rate of 1/500 of a second can not be discriminated as distinct sounds, and probably we can not here distinguish the duration of the successive from the simultaneous, but the successive feel bigger than the simultaneous. Not only the velocity of certain electric currents, therefore, but a certain velocity of nerve currents produces an apparent mass.

But modern physical science has been quite untouched by psychological investigation. What modern science has been concerned with has not been perceptual extension with varying conditions, but an artificial unit of extension or perception under standard conditions, as, for example, the steel-yard kept at a certain temperature and other uniform conditions in the British Museum. As long as this conventional unit could be applied under definite conditions, mass still maintained its hold as an ultimate attribute of physical reality. I say physical reality because the field of investigation, where mass units have been applied, has been narrowed down to this. Philosophy since Descartes has recognized that there is no sense in speaking of an extended will. However, even in physical science, serious doubts have arisen, though on experimental and not *a priori* grounds, as regards the reality of extension and even of weight. What has given rise to this doubt in recent science is the demonstration that neither mass nor even weight can be regarded as an absolute constant, and that, therefore, recourse must be had, for descriptive purposes, to a more ultimate concept. It has been shown by Lorentz that even mechanical mass in motion must vary with the electrodynamic field, and so is not constant. Mass, moreover, does not seem to apply with equal force to all energy: there seems to be little relevancy in speaking of electricity as having either mass or weight.

The greatest blow to the conception of mass has come from recent investigations into the nature of electricity. It has been shown that mass can actually be produced through velocity. Kaufmann, J. J. Thomson, and others have demonstrated ''that if the velocity of a charged body is comparable with that of light, the mass of the body will increase with the velocity.[2] And not only that, but the experiments and calculations, according to Thomson, ''support the view that the whole mass of these electrified particles arises from their charge."[3] As a number of brilliant physicists, including J. J. Thomson, Rutherford, Strutt, etc., take the view that the atom can be resolved into negative electric charges held together by positive electricity spread over a wider volume, it is only a short distance to the view that there is "no mass other than electrodynamic inertia. But, in this case, the mass can no longer be constant; it augments with the velocity and it depends on the direction, and a body maintained by a notable velocity will not oppose the same inertia to the forces which tend to deflect it from its route as to those which tend to exhilarate or to retard its progress."[4]

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[2] J. J. Thomson, "Electricity and Matter," p. 34.

Such a theory, for mathematical reasons if for no other, will be slow in gaining acceptance among ordinary chemists; but it is not any the less interesting theoretically on that account. Possibly the seventy or eighty elements of modern chemistry may be simplified by means of such a theory, but of such a simplification we have only hints at present. The recurrent similarity in the geometrical groupings which free magnets spontaneously assume in an electromagnetic field as you increase their number, as shown by Mayer's experiments, furnishes a direct analogy to the periodic law of the chemical elements and to the recurrent characteristics of these elements as shown by spectral analysis. The positive or negative chargeability of various elements shows at least an intimate connection between them and electrical energy. This theory tries with wonderful plausibility to account alike for the stability of the ordinary chemical elements and the unstability of the radioactive substances; but its most interesting aspect to us is that, like the earlier metaphysical theories of Leibniz and Boscovich, it reduces mass to energetic terms. Thus in modern physical science we have passed from a physical world which is made up of mere geometrical figures enclosing extension, as in the case of the Cartesians, to one that is non-extended, or where extension is merely a secondary function of energy. How far this hypothesis can be adopted for all

[3] It is only fair to say that Thomson in more recent publications has modified his view. As I understand it, he does not now regard it proven that the sum of the apparent masses of the negative charges equals the total mass of the atom. There is a residium of gravitational mass which must be accounted for in other ways. This is now a matter of controversy. But in any case the Cartesian idea of atoms as rigid, mathematical figures has been exploded. Both the shape and the magnitude of the atom vary with the velocity and the magnetic field. They can be changed by pressure. Energy, not mass, becomes, therefore, the primary physical reality. The atom, Thomson has shown, can be stated as the sum of its internal energy and the energy of translation.

[4] M. H. Poincaré on "The Value of Science," *Popular Science Monthly,* Vol. LXX., p. 349. For the electrical theory of matter see the lucid exposition by Hon. R. J. Strutt, in his work entitled "The Becquerel Rays and the Properties of Radium," especially pp. 184–193.

physical purposes, convenience must decide. Whether it can be regarded also as an ultimate hypothesis holding good for the whole of reality, we shall discuss later.

The motive for inventing realistic substances was no doubt the need of accounting for the seemingly potential character of things, or, to express the same idea in other words, to meet the need of social expectancy. But it has always been difficult to make clear what potential means. Where are the manifestations of light and heat when they are not manifestations? Where is the storehouse of our ideas when we do not think of them? What does the potential mean excepting that one set of changes can, under certain conditions, give rise to another set of changes; that, perhaps, what is not experience can, under certain other conditions, give rise to experience? Thus chemical changes can give rise to electrical or nervous changes. Physical energy, as light rays, is possible light in the sense that physical energy may give rise to chemical changes in the retina and these again to nerve changes in the optic nerve and occipital lobes, and these changes again to psychic processs. Thus you have the sensation of light. But physical energy, as such, is neither potentially nor actually light; it is itself. The potential, therefore, does not need to mean the static; it simply means that one set of changes is the occasion for another set of changes under certain describable conditions. And that, failing these conditions, the changes do not take place. This is the meaning of the terms possible and impossible in nature.

The most consistent attempt to state the potential is that of Anaxagoras. According to him, the fruit of Demeter which we eat and the water which we drink must contain the germs of blood and tissue and bone and hair which they serve to build up. The reason that things can produce such different results in different combinations is that everything contains a portion of everything. It is only the proportion of the elements which varies and which determines the character of the particular thing. If pain is present in all stimuli of a great intensity, then it must really be a property of those stimuli at any intensity. On such a theory, as well as according to its more modern successor, the qualitative theory of Herbart, every effect can be said to be potentially present in the sense of actually existing in the conditions which give rise to it; and recent common-sense theories as to the reality of qualities seem to point in the same direction. The difficulty with all of these theories is that we have no evidence that the bright and the dark, the dry and the moist, the heavy and the light, or any other perceptual qualities exist until they appear under certain conditions. The potential, therefore, is merely a hypothetical statement of what effects will appear, given all the conditions or the definite complex.

The need for constancy or uniformity, however, does not require absolute uniformity or absolute constancy. After all, we have no right to assume any more constancy than we find. The chemical elements do, indeed, possess a high degree of constancy, excepting, perhaps, the more recently discovered ones, such as radium; and yet we have no right to assume that they are absolutely constant. When we come to the more plastic organic and psychological processes, constancy becomes much more relative. According to the pragmatic test, generally stated, there is just as much stability or substantiality as there seems to be or as we must acknowledge. What is the use of assuming a stability which can not be verified. No doubt Plato and Aristotle are right, that the "science of those things which are in a state of flux has no existence."[5] But our world furnishes at least such a degree of uniformity as makes a reasonable adjustment to the future possible.

The weakness in the statement of the metaphysical realistic substances, which the idealistic critics have not been slow to point out, is that, inasmuch as these substances are independent and indifferent to the various combinations in which they enter, they can not account for the apparent processes, whether physical or perceptual. The material atoms become as useless to account for the physical changes as the soul substances become superfluous in accounting for the stream of conscious processes. The substances, in other words, must be known through their activity; and, therefore, activity, and not substance, becomes the fundamental thing; substances so called are a mere hypostatization of the relative uniformiites and constancies, physical and psychological, which we observe.

The other venerable hypothesis which tries to furnish a setting for our finite experience and to account for its coming and going and its relativity, is that of absolute idealism. The history of this theory is easy enough to trace; and one can not help regretting that the unity of apperception of Kant, which merely emphasizes that the world is coherent if we are sane, should have been converted into a cosmic unity, a unity of nature, by Kant's successors. To them being strung on the unity of our social interests or purposes means that nature herself must be thus strung, must be an ontological and reflective whole. This theory has, indeed, done a great service in emphasizing a part of reality, neglected on the whole by the old realism, namely, that of ideals and institutions. Its insistence upon an ideal of systematic unity has had its great importance, too, as an ideal of knowledge. Even if reality can not be regarded as such a systematic unity of experience, the dream of science must be to weave together our human purposes and interests

[5] Aristotle, "Metaphysics," Book XII., Chap. 4, § 3.

into such a unity. Epistemologically, therefore, the theory has done great service, whatever may be its one-sidedness. It has also fulfilled and will always fulfill an important religious function in many lives in which the esthetic and intellectual craving is more prominent than the ethical and practical.

But, in spite of the historical importance of this venerable hypothesis, it has striking weaknesses. It is not at all clear how an eternal and complete system of experience can account in any way for the coming and going, the tragedies and successes, of our experience. The absolute as an hypothesis fails as completely, and for the same reason, as the realistic substances in meeting the world of process; and we must go to work, therefore, independently of such an hypothesis, beautiful and esthetically satisfying as it may be, to meet the problems of our finite world of change.

Moreover, as Plato has long ago pointed out in the "Parmenides," not only could not such a system of ideals meet the problems of change, but the absolute could not know our finite world, nor could we know it. That we could not know it must seem apparent enough, for if we knew what an absolute experience is, we should already now possess such an absolute experience, as, indeed, the absolute idealists have not been slow to claim; but, even in that case, we, after all, know only what we know. The absolute itself becomes merely our construction or our definition of our finite experience; and we have failed to reach the permanent and eternal for which the absolute was supposed to stand. Our absolutes must vary with the growing insight of the individual and the race, with the evolutionary process of human experience.

If we can not know the absolute, neither can the absolute know us. It could not know our failures, our ignorance, and our despairs as these failures and ignorance and despairs are for us. The very fragmentariness of these human experiences from the absolute point of view would convert our despairs into hopes, our tragedies into comedies, and our failures into successes. Such an absolute, then, even if it existed, could not account for the world of change, with its adjustments and maladjustments and its different levels of appreciation. Like the realistic substances, it is a hypostatization and possesses all the relativity that the unity of finite human experience, which created it, must possess. That which explains process must manifest itself in the process, and, therefore, must itself be process. The meaning we can snatch from the flux of things possesses, indeed, a certain eternity while it lasts; it aids us to prepare for the future, as prophetic of the larger insight and the larger experience to come. But as for absolute permanence, we know this even less in the field of human experience than in the case of chemical elements. The old static view of being, therefore, has given place to the view of dynamic processes, whether as regards the atoms of the physical sciences or the images and concepts of psychology. Being = energy.

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DISCUSSION

THE LOGICAL CHARACTER OF IDEAS

SAID John Stuart Mill: "To draw inferences has been said to be the great business of life. . . . It is the only occupation in which the mind never ceases to be engaged." If this be so, it seems a pity that Mill did not recognize that this business identifies what we mean when we say "mind." If he had recognized this, he would have cast the weight of his immense influence not only against the conception that mind is itself a substance, but also against the conception that it is a collection of existential states or attributes without any substance in which to inhere; and would thereby have done much to free logic from epistemological metaphysics. In any case, an account of intellectual operations and conditions from the standpoint of the role played and position occupied in the business of drawing inferences is a different sort of thing from that which regards them as having an existence *per se*, and which treats them as marking some sort of existential material distinct from the *things* which figure in inference-drawing. This latter type of treatment is that which underlies the psychology which itself has adopted uncritically the remnants of the metaphysics of soul substance: the idea of accidents without the substance.[1] This assumption from metaphysical psychology—the assumption of consciousness as an existent stuff or existent process—is then carried over into an examination of knowledge, so as to make the theory of knowledge not logic (an account of the ways in which valid inferences or conclusions from things to other things are made), but epistemology.

We have, therefore, the result (so unfortunate for logic) that logic is not free to go its own way, but is compromised by the assumption that knowledge goes on not in terms of things (I use

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[1] This conception of "consciousness" as a sort of reduplicate world of things comes to us, I think, chiefly from Hume's conception that the "*mind* is nothing but a heap, a collection of different perceptions, united together by certain relations." "Treatise of Human Nature," Bk. I., Pt. IV., Section 2. For the evolution of this sort of notion out of the immaterial substance notion, see Bush, "A Factor in the Genesis of Idealism," in the James *Festschrift*.